

BUILDING A CAMPUS STATION IN WAR TIME

Since the start of the war it has been relatively difficult to establish a campus radio station. As a result, the number of stations in IBS has remained essentially constant, and even a few stations have found it necessary to close.

Recently, conditions for establishing a station have grown more favorable, as evidenced by the recent opening of a station at Bucknell, and the reopening of the stations at Wesleyan and Princeton, both of which had been forced off the air because of reduced student operating personnel.

As can be imagined, the two main problems to be solved when establishing a campus station are obtaining the equipment needed, and finding students having the time and ability to make the installation and produce the broadcasts. The existence of IBS proves that the students are available. At most schools there are engineering and other science major students, and these are the ones who greatly help with building the station. Also, it has become apparent that it is possible to produce interesting daily programs with much less effort than is required, for instance, to publish a daily campus newspaper. The result has been that campus stations have maintained two or three hour daily schedules at colleges where the daily paper has had to curtail its publication to one issue a week, or even disband for the duration.

-Required Facilities and Equipment-

The following basic facilities and equipment are required to start a campus station:

1. Space for studio and control room.
2. Studio equipment.
3. Transmitter.
4. Transmission system.

-Studio and Control Room-

In the most simple installation, the studio and control room can be combined. This arrangement limits the flexibility of the station, and makes it difficult to produce other than record shows and talks by one or a few persons. The more preferable arrangement is to partition off the control room, providing it with a floor raised about 16 inches above the studio floor, and a double glass window through which the control operator can observe the program. More elaborate stations also provide a viewing window for an audience, and more than one studio. One control room can be arranged to service two or three studios, or each studio can be arranged with its own control room, in which case master control facilities are required to combine the output of the various studios before the program reaches the transmitter. It is obvious that these more elaborate arrangements offer many advantages, such as rehearsals during broadcast time, but they can be added later.

BUILDING A CAMPUS RADIO STATION IN WAR TIME

Since the start of the war it has been relatively difficult to establish a campus radio station. As a result, the number of stations in the U.S. has remained essentially constant, and even a few stations have found it necessary to close.

Recently, conditions for establishing a station have grown more favorable, as evidenced by the recent opening of a station at Bucknell, and the reopening of the stations at Wesleyan and Princeton, both of which had been forced off the air because of reduced student operating personnel.

As can be imagined, the two main problems to be solved when establishing a campus station are obtaining the equipment needed and finding students having the time and ability to make the installation and produce the broadcast. At most schools there are engineering and other science major students, and there are the ones who greatly help with building the station. About 15 has become apparent that it is possible to produce interesting daily programs with much less effort than is required for in-station, to conduct a daily campus newscast. The result has been that campus stations have maintained two or three hours daily scheduled broadcast where the daily broadcast has had to curtail its broadcast to one hour a week, or even stopped for the duration.

For an untrained personnel and equipment the required to

start a campus station:

1. Space for studio and control room.

2. Studio equipment.

3. Transmission equipment.

4. Transmission tower.

In the most economical way, the studio and control room can be combined. This is usually done in the flexibility of the station, and what is usually required is a room record shows and built by separate means. The more desirable arrangement is to have the control room, including it with a floor raised about 18 inches above the studio floor, and a double glass window through which the control room can observe the program. More elaborate stations also provide a viewing window for an audience, and more than one studio. The control room can be arranged to service two or three studios, or each studio can be arranged with its own control room, in which case master control facilities are required to combine the output of the various studios before the program reaches the transmitter. It is obvious that these more elaborate arrangements offer many advantages, such as rehearsal during broadcast time, but they can be added later.

-Studio Treatment-

It must be remembered that a studio is not just a room with some microphones. If undesirable echos, or reverberations are to be avoided, the studio walls, ceiling and floor must be treated with sound absorbing material. Again, an elaborate installation is not needed to be effective. Drapes of monk's cloth on the walls, a false ceiling of cheese cloth supported by lathe, and a carpet on the floor, can be used to good advantage. One wall of the studio should be left without treatment. Movable flats or "gobo" boards built of sound absorbing material to cover as much of this wall as required. Experimentation with placement of microphones, gobo boards and actors will quickly show what studio arrangement will give a program having enough "live" quality to satisfying, and yet not result in excessive reverberation.

-Studio Equipment-

Minimum studio equipment required is as follows:

1. At least two microphones, one with floor stand, and other with table stand or combination floor and table stand.
2. At least two 78 rpm. phonograph turntables with pickups. Turntable diameter may be eight inches for commercial recordings up to twelve inches.
- * 3. If at all possible, one 33 1/3 rpm. transcription table with pickup, for up to 16 inch diameter lateral cut transcriptions.
4. Studio control console, or mixer, having at least four channels. These channels should preferably permit mixing or blending four inputs simultaneously. Two channels should provide gain adequate for the microphones, the other two should be suitable for the phonograph pickups. By means of switches or jacks the phonograph channels should be arranged to connect and alternate inputs, such as the transcription pickup.
5. Telephone headset or earphones to monitor the program.
6. Volume level meter to monitor the program.
- * 7. Separate amplifier with speaker to monitor the program. If the transmitter can be received in the studio, this may be a good quality radio. If there is danger of feedback between the monitor speaker and the microphones, an automatic switching circuit must be installed to turn off the speaker when the microphones are switched on.
- * 8. FM tuner for relaying FM programs. This is fed into the mixer in place of one of the phonographs.

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-Studio Equipment-

Minimum studio equipment required is as follows:

1. At least two microphones, one with floor stand, and other with table stand or combination floor and table stand.
2. At least two 78 rpm. phonograph turntables with pickup. Turntable diameter may be eight inches for commercial recordings up to twelve inches.
3. If small possible, one 33 1/3 rpm. transcription table with pickup, for up to 12 inch diameter lateral cut transcriptions.
4. Studio control console, or mixer, having at least four channels. These channels should be capable of being mixed in any desired proportion. Two channels should be used for the microphones, and other two for the phonograph pickups. By means of switches or jacks the microphone channels should be arranged to connect and alternate inputs, such as the transcription pickup.
5. Telephone headset or earphones to monitor the program.
6. Volume level meter to monitor the program.
7. Separate amplifier with speaker to monitor the program. If the transmitter can be used in the studio, this may be a good quality radio. If there is danger of feedback between the monitor speaker and the microphones, an automatic switching circuit must be installed to turn off the speaker when the microphones are switched on.
8. If space for playback is required, this is fed into the mixer in place of one of the phonographs.

- * 9. Line matching unit to connect remote line to mixer for remote programs. This, too, is connected into the mixer in place of one of the phonographs.
- * 10. Remote Pickup equipment, control room-to-studio talkback circuit, and other refinements.

-Microphones and Phonographs-

Public address type microphones, phonograph turntables and pickups can be used to start a station, and often can be obtained by canvassing students, the local radio supply dealers, and others. Later, better units should be purchased when possible. Most of the microphones so obtained will be of the high impedance variety, but in planning station growth the fact should be kept in mind that low impedance microphones are best because of reduced microphone cable maintenance and longer permissible microphone cable lengths, in spite of their greater initial cost and the need for a matching transformer between the microphone cable and the grid of the preamplifier tube.

Phonograph turntables and pickups are difficult to find, and the less expensive turntables will be a frequent source of trouble since they are not designed for the broadcasting duty. "Permanent" needle pickups are not recommended because their life is relatively short in broadcasting service. It is better to put up with the bother of changing needles, than have to purchase a new cartridge, or return the old one to the manufacturer every three or four months. If necessary it is possible to convert some permanent stylus type pickups to the type with removable needle.

Unfortunately, the transcription turntable will be quite difficult to find, but diligent searching will be rewarded because of the increased field of program material the 33 1/3 speed makes possible. Sometimes college stations arrange to borrow transcriptions from local stations, and IBS releases transcribed programs from time to time.

-Studio Console-

The studio console can be made by the student technicians or may be converted from a public address amplifier.

Unfortunately, there are relatively few public address amplifiers having the desired number of input controls and which do not have a power output far in excess of the needs of the station. Nevertheless, a high powered public address amplifier can be modified for studio use in one of the following ways:

1. Utilize audio output to modulate the transmitter.
In general, the amplifier should be operated at about half rated power, as a compromise between too much distortion at rated power level, and excessive hum at low power levels. If this optimum power level is greater than required to modulate the transmitter, it must be reduced by resistance attenuators, or pads. Also, since most public address amplifiers have an output of 500 or 600 Ohms, a matching transformer will be required to correctly modulate the transmitter.

* These units are not needed for the most simple record type shows, and so can be added as the need arises.

* 9. Line matching unit to connect remote line to mixer for remote programs. This, too, is connected into the mixer in place of one of the phonographs.

* 10. Remote pickup equipment, control room-to-studio talkback circuit, and other refinements.

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* These units are not needed for the most simple record type shows, and so can be added as the need arises.

2. Utilize audio output to feed remote line to transmitter. In this case the impedance level of 500 or 600 ohms is all right for the line, but a resistance attenuator capable of reducing the power across the line to .006 watts is required.
3. Utilize the audio output to operate the studio monitor speaker. Attenuation in power output will be required, because about one watt is all that is required for the studio speaker. It will also be necessary to provide a speaker cut-out switch or relay, as previously described.
4. Rebuild the amplifier to eliminate the output stage, or reduce the power output to the desired value for one of the above uses by substituting smaller tubes. In this event, care must be taken not to cause the power supply voltage to increase on the other stages, since instability or failure of parts from high voltage may result.

Instructions for building studio console equipment can be found in radio magazines, or may be obtained from the IBS Technical Department. However, since it will be necessary to construct the transmitter for the station, it may prove less difficult to start broadcasting with a modified public address amplifier, and build specially designed studio console later.

-Earphone Monitor-

The telephone headset can be connected into the circuit at any point where suitable volume is obtained, the only requirement being that no adjustment of the program level or addition of program material takes place after the point where the earphones are connected.

-Volume Indicator-

Many public address amplifiers are equipped with a volume indicator meter. A standard VU meter is the preferable type, but any meter calibrated in db. can be used. If no meter is available, a vacuum tube rectifier can be used to rectify audio voltage and drive a sensitive d-c milliammeter or a tuning indicator tube can be driven from the same type of rectifier. Some visual, calibrated, indication of program level is mandatory if distortion from overmodulation, or wide variations in program level are not to result.

-Transmitter-

It will not be possible to buy a small broadcast transmitter and so one must be built. From circuits available from the IBS Technical Department it is possible to choose a design which will adequately cover any given campus or building. As a rule, a transmitter having a radio frequency output of about five watts is adequate. A transmitter of this size can be constructed from radio receiver components, and so is within the realm of possibility no matter how scarce material

2. Utilize audio output to feed remote line to transmitter. In this case the impedance level of 500 or 600 ohms is all right for the line, but a resistance attenuator capable of reducing the power across the line to .008 watts is required.

3. Utilize the audio output to operate the studio monitor speaker. Attenuation in power output will be required because about one watt is all that is required for the studio speaker. It will also be necessary to provide a speaker out-out switch or relay, as previously described.

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Instructions for building studio console equipment can be found in radio magazines, or may be obtained from the IRE Technical Department. However, since it will be necessary to construct the transmitter for the station, it may prove less difficult to start broadcast with a modified public address amplifier, and build specially designed studio console later.

-Telephone Monitor-

The telephone handset can be connected into the circuit at any point where suitable volume is obtained. The only requirement being that no adjustment of the program level or addition of program material takes place after the point where the earphones are connected.

-Volume Indicator-

Many public address amplifiers are equipped with a volume indicator meter. A standard VU meter is the preferred type, but any meter calibrated in db. can be used. If no meter is available, a vacuum tube rectifier can be used to rectify audio voltage and drive a sensitive d-c milliammeter or a tuning indicator tube can be driven from the same type of rectifier. Some visual, calibrated, indication of program level is mandatory if distortion from overmodulation, or wide variations in program level are not to result.

-Transmitter-

It will not be possible to buy a small broadcast transmitter and so one must be built. From circuits available from the IRE Technical Department it is possible to choose a design which will adequately cover any given range of output. As an example, a transmitter having a radio frequency output of 100 watts is adequate. A transmitter of this size can be constructed from radio receiver components, and so is within the realm of possibility no matter how scarce material

are. If several good a-c operated radios can be obtained for the project, they will generally yield enough parts for power supply, modulator, tuning capacitors and coils for the radio frequency stages, and so forth. The IBS Technical Department will be glad to draw up special circuits of transmitters utilizing parts obtained in this manner.

-Transmission System-

Of the many transmission schemes available to the college broadcaster, the one which has proved most reliable and least likely to cause interference from radiation is a network of overhead or underground twisted pair lines feeding power from a transmitter to the 110/220 volt lighting circuits in the buildings to be reached. The line is coupled into the a-c circuit in each building near the fuse box through fuses and blocking capacitors rated between 0.01 to 0.006 mfd., 500 or more volts. This system provides good coverage throughout each building. If required, a licensed electrician can easily make the required connections.

The main problem will be with obtaining wire. A twisted pair conductor is required to prevent radiation, and if an overhead installation is required, it must be weather resistant wire. A possible source of wire is the local power or telephone company, who might donate used wire which could be salvaged by cutting out the worse sections and splicing. In similar fashion, the campus buildings and grounds department might have scrap wire. Indoor extension cord wire can be used if nothing else can be found, but most types will not long withstand outdoor weather conditions. If the campus is equipped with steam tunnels the lines should be installed in them, since a reduction in line maintenance and radiation of radio frequency energy from the line will result.

-Future Growth-

If, by exercising ingenuity and effort along the lines described above, it proves feasible to start a station of demonstrative worth to the college community, maintenance priority rating can be obtained. This priority will permit the purchase of more suitable equipment and materials to take the place of the initially installed apparatus. This priority can be obtained with the help of the college buildings and grounds department, who have a similar one for the maintenance of the campus facilities.

D. W. Borst
Technical Manager
I. B. S.

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I. B. S.
Technical Manager



Haverford College

HAVERFORD, PA. 19041 215-649-9600

July 2, 1973

Cope & Lippincott Architects
1637 Race Street
Philadelphia, Pa. 19103

Attn: Mr. H. M. Lippincott

Re: Radio Station WHRC

Dear Mather:

Several weeks ago I met with Steve Bronstein '75, the student most concerned with the operation of the radio station during the coming school year. Below are listed his comments and suggestions on the present and (hopefully) future facilities:

1. Rooms:

The present three-room layout is satisfactory, but they would prefer four if possible.

- a. Studio - turntables, tape decks, control board, etc.
- b. Record Library - audition turntable, shelves, aisle stacks.
- c. Production Room - two turntables, tapedeck.
- d. Work Room - bench and tools for repair work, closet and shelves for storage.

2. Arrangement:

The Studio should be in the middle, with the Library on one side, and Production Room on the other. The Work Room can be located at either end, but all four rooms should open onto a common hall, providing access to each room individually --- it should not be necessary to use any room as a passageway.

3. Finish:

Studio, Library, and Production Room should all be acoustically treated. There should be sound-proofed glass between the Studio and two adjoining rooms.

4. Special Wiring:

Conduits should be installed above suspended ceilings from WHRC to the News Area, Student Council, Coop, Lounge, and two main Dining Rooms. Microphone receptacles should be provided in each of the above areas, plus speakers in the Coop. This will permit broadcasts from those areas, if desirable.

No doubt there are a host of other requirements which you are familiar with, but this will at least get us started. The room in the Dining Center basement which we had talked of using for WHRC is presently being used as a storage room by the Summer Conference Program, but we can ask them to vacate it in late August if necessary for construction.

cont.

Keep us advised of your progress in this matter and let me know if you want to discuss plans directly with Steve Bronstein. He is living nearby and I'm fairly sure we can arrange a meeting on short notice.

Very truly yours,



Elmer J. Bogart
Supt. of Bldgs. & Grounds

EJB/j

cc: Steve Cary
Steve Theophilos
Steve Bronstein✓

Brief Notes on the WHRC Studios

Aug. 20, 1974

Roger Barthelson

General Wiring

All audio wiring between points within the station is done with Belden 8451, except for speaker connections which are made with clear zip cord or speaker cable. Belden 8451 is the same cable found in the console. It consists of two insulated stranded inner wires (red and black), an uninsulated ground wire and the grounded foil shield. In most cases only the red wire and the ground wire are used (for signal and shield ground). The black conductor was grounded on one end only. A strange but true principle has been found to hold true in the wiring of this station. Any ground point such as the metal cover for one of the jack boxes should be grounded by only one conductor (wire). Otherwise circulatory currents will cause hum problems. For example, if two cables running from the console to the remote box have their shield wires connected to the ground lug of their phono jack mounted on the metal plate, hum will appear in those remotes at the console.

Since all wiring is encased in grounded metal wire, no shields need be connected to the ground lugs on the face plates of the jack boxes; the face plates are grounded by connection to the wiremold boxes. In some cases the grounding of the shield at the may make no difference, because the cable carries only high level material from the console.

Almost all cables at the console have their ground leads grounded at the console and if the black lead is unused, it is grounded at the console also. Microphone connections require the use of both red and black wires for the balanced microphone output and the ground wire always goes to the ground on the boxes and to pin one on the connector.

Most wiring terminates at jack boxes. In many cases patchcords with appropriate connectors are required to connect equipment to these boxes.

One possible point of confusion: speaker wiring is done in some places with two pieces of shorted zip cord. This was done because the zip cord was found to have a rather low current rating. Also, some audio cables running over the record library ceiling are connected to nothing and extend from the console; they were for the phone box which turned out not to be located in the record library.

The Console

The console is the heart of the station, so almost everything is connected to it. In fact, any signal produced in any of the three rooms can be directly or indirectly monitored on the console for program or audition use. Program and Audition outputs coming through two 120,000 ohm resistors each (to avoid loading these outputs and to reduce level) run to the two tape boxes, the production box, and the record library amp box. Feedback (motor-boating sound) will occur if one of the units at one of these boxes is monitoring audition or program while at the console the output from the unit is switched into either audition or program (whichever the case).

All mike box connectors are labelled with the mike channel into which they feed on the console. Almost all mike boxes connect to the console even though some may be connected to the production box, too. Since there are only four mike inputs on the console there is some overlap on these connections. All mike jacks in the Studio should connect to Mic 1 or 2 because this channel cuts off the monitor when switched to program or audition, thereby avoiding feedback.

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Any box that has a jack that connects to one of the inputs on the console is labelled with the number of the switch at which it appears on the console.

The turntable outputs appear at channels 5 and 6. The output of the cart machine appears at the switch labelled 7. Wiring for these devices is underneath the counter. There is a two-channel preamp for the turntables that runs continuously mounted under the counter. A special line from the console monitor that runs to the cart machine for taping.

Production Room

The Production Room is designed so that it can be used as an actual separate studio with the remote unit functioning as console. In back of the remote unit are many jacks designed to connect to the remote unit with patch cords. Some carry signals which can be connected into any appropriate channel on the remote unit. Others carry: 1) program material out to the tape boxes, to the studio console and to the cart box in the production room or 2) monitor speaker out to the speaker box above the shelf. Signals coming in include those of the turntables (these should be patched into the channels with phono jacks in the back) the Reel- to- Reel tape output, the cart box output, Audition and Program signals and microphones. The remote unit should not be left running when not in use.

Microphones--The double-jack mike box behind the remote unit carries the signal from the other double box located on the right-hand wall. This set-up is intended to act like a built-in extension cord. The single jack mike boxes are presently useless. Plans originally called for a security cabinet around the remote unit; these boxes were installed to extend a microphone right outside the cabinet to the

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inside. Plans for the cabinet were changed.

The cart box in the right corner has one jack to carry the output from a cart machine to the remote unit. Another jack carries the output of the remote unit for taping on a cart machine.

Record Library

The heart of the record library facilities is the Dynaco preamp. Coming in to the preamp are Program and Audition from the console and the output from the turntable. The preamp connections are made through the amp box above the counter. The output from the preamp feeds through the amp box to the console. It also connects directly to the Dynaco power amp which drives a speaker with roughly a 20 watt output. The primary purpose of this setup is to audition records. However, what is played in the record library can be used in the studio on the console. The amps in the record library should not be run continuously. Note: there is a speaker line running from the amp box to a box on the back wall. This was intended for a shelf speaker, but presently the speaker is too large and there is no shelf.

General Problems

1) Avoid switching the plugs in the jacks on the various jack boxes unless you know what you are doing. Damage to expensive equipment can result if the wrong plug is plugged into the wrong jack.

2) Patchcords will receive some wear; they may short or otherwise become faulty. In order to unplug anything, the body of the connector should be grasped, not the cord.

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2) Patchords will receive some wear; they may short or otherwise

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should be grasped, not the cord.

3) Feedback will be encountered if, for example, the remote unit is monitoring program and the production output is mixed into program at the console. The same can occur with the Dynaco preamp in the record library.

4) Hum can be caused by insufficient grounds or too many grounds. Shields on audio cables must be grounded, but circulating currents may cause hum if two or more ground paths exist. Balanced lines such as phone lines must be fed through an unbalancing transformer before being amplified; otherwise, much hum is introduced with the signal.

Transmitters

All the carrier current transmitters should be driven by a distribution amplifier which amplifies the signal coming from program out of the console.

Locations Coverage

Haverford Campus

Lunt Basement (Tech Room) North Dorms, Lloyd

Barclay Basement ✓ Barclay

Gummere Basement Gummere, Leeds

Bryn Mawr Campus

Rhoads Basement (Power Room) Rhoads

Radnor Basement Radnor

Merion Basement Merion

Denbigh Basement Denbigh

Pembroke West Basement Pem East and West

Erdman Basement Erdman

Haffner Basement (Tech Room) Haffner

It is assumed that the system is designed to monitor the program and the production output is given to the console. The same can occur with the system output in the console.

4) Hum can be caused by insufficient grounds or too many grounds. Shields on audio cables must be grounded, but circulating currents may cause hum if two or more ground paths exist. Balanced lines such as phone lines must be fed through an unbalancing transformer. (The transformer should be grounded to the ground plane.)

All the carrier current transmission lines are connected to a common distribution amplifier which amplifies the signal coming from the console.

Haverford Campus	North Downs, Lloyd
Hunt Basement (Tech Room)	North Downs, Lloyd
Commerce Basement	Commerce, Leeds
Merion Basement	Merion
Pembroke West Basement	East and West
Halliner Basement (Tech Room)	Halliner

Resources

ARRL Radio Amateurs Handbook

LPB

Handbooks to Console and other equipment

Peter Barthelson, WA3TFP

Box 379, RD 2

Hockessin, Delaware 19707

302-239 4308

Good Luck

ENCLOSURE

1001 1001 1001 1001 1001

1001 1001 1001 1001 1001

1001 1001 1001 1001 1001

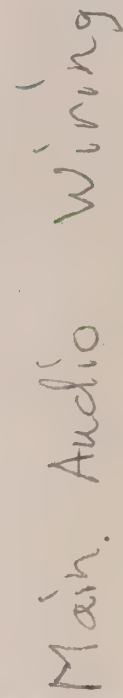
Box 379, RD 2

Hockessin, Delaware 19707

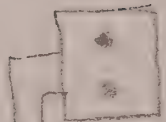
802-539 4308

Good Luck

PRODUCTION ROOM



Record Library



Studio



Production



Microphone Connections

Copy to William Lupoletti



UNITEL INTERNATIONAL
TELEVISION FOUNDATION

22210 VICTORY BOULEVARD
SUITE D-102
WOODLAND HILLS, CALIFORNIA 91367

BLE ADDRESS: UNITEL WOODLANDHILLS
LEPHONE: 213/884-6206

October 12, 1979

Mr. Thaddeus S. Mazurczyk, Chief Engineer,
Radio Station WHRC,
Haverford College,
Haverford, PA 19041.

Dear Thad:

In my letter of June 27, 1979, addressed to you at your home address, 9 South Cherry Lane, Rumson, New Jersey 07760, I stated that I had been in touch with Richard Crompton, the president of LPB, Inc., Frazer, Pennsylvania, about the FCC problem that is presented by use of a very low-power FM radio transmitter to supply program signals in the dormitories.

I indicated in my letter that it might be possible to arrange for the loan of one of LPB's carrier-current transmitters, so that you could use it in connection with a radiating cable. I have just heard from one of my associates, Richard Burden, who installs LPB low-power radio equipment in colleges and universities in the Los Angeles area, that Mr. Crompton will make available to you, on a loan basis, one of his latest transmitters. This will provide an audio-frequency range from about 40 to 15,000 Hz, with a signal-to-noise ratio that will be in excess of that provided by standard AM broadcast stations.

Also, Mr. Burden will make a gift of at least 500 feet of his radiating cable. This provides about the same results, when not buried in earth, as those obtained with my cable that has three conductors and is about $3/4$ inch in diameter. Burden's cable is only about $1/4$ inch in diameter, so it is very easy to handle and install. Also, the RF impedance is 50 ohms. This will match the output impedance of the LPB transmitter and will not require the "Power Line Interface" unit that was mentioned in my letter to you.

As you would like to be able to provide stereo broadcast signals in the dormitories and as the FCC will not permit the use of low-power FM transmitting equipment for this purpose without a license from the Commission, I suggested in my letter that when you get the new LPB transmitter and the cable, (which will be provided with coaxial fittings and a 50-ohm termination unit

supplied by Mr. Crompton's firm) it might be a good idea to have the transmitter tuned to either 530 or 540 kHz. This transmitter might be used in providing the "right" stereo signal; the equipment that you now have in service will provide the "left" stereo signal.

With such an arrangement, using two transmitter frequencies, it should be possible to obtain very good stereo reception in the dormitory served by the two transmitters, with greater stereo "separation" than can be obtained with the present FM stereo broadcast system. As firms such as Radio Shack and others now are marketing very low-cost AM broadcast receivers that are in the \$10.00 to \$12.00 price range and as these receivers, even when using a speaker as small in diameter as 2 1/2 inches, can provide quite a good audio response, those students whose rooms do not have two portable AM receivers could use their existing AM broadcast receiver to reproduce the "left" stereo signal and purchase one of the low-cost receivers so that "right" stereo signal would be reproduced.

In reception tests that I have made recently at a drive-in theatre that uses my cable-radio system, I have used a small portable AM broadcast receiver in conjunction with the speaker that is associated with my standard car-radio equipment. When the audio signals are heard from both speakers, a great improvement in audio performance was noted. Although the drive-in has not yet installed stereo equipment, the use of the two speakers, which were spaced about two feet apart, greatly improved the over-all effect when the signals were heard in the car. If the drive-in theatre had used two transmitters, I am sure that the stereo effect would have been excellent.

A possibility that I have been thinking about is that if the funds could be obtained in some way it might be possible to use a 100-watt stereo broadcast transmitter in the lower part of the FM broadcast band that has been reserved for use by colleges and universities as well as by the Public Radio Service. With such transmitting equipment, assuming that there is an open FM channel left in the Philadelphia area, a good stereo broadcast signal would be received in all dormitories at Haverford and at Bryn Mawr College. By use of a directional transmitting antenna, located on a post at the top of what I knew as the Physics Building*, maximum RF signal strength would be provided in the direction of Bryn Mawr, with a good signal within a distance of about 10 miles. What is your reaction to this idea?

As soon as I hear from Mr. Crompton about the transmitter and cable matter, I'll get in touch with you. His new building is now located at 28 Bacton Hill Drive, Frazer, PA 19355. His phone number is 215/644-1123. His plant can be reached easily from Haverford by taking U. S. Route 30 east to Frazer. I understand

*I believe this is Sharpless Hall

that his plant can be reached within less than an hour's drive from Haverford. So it appears to me that the best procedure to follow in getting the equipment would be to go to Frazer by car and pick up the transmitter, cable, coaxial fittings and the termination unit. Also, this will give you an opportunity to meet with Mr. Crompton and discuss the operation of the equipment with him. He also can tell you about his 10-watt FM stereo broadcasting products that I understand a number of colleges now are using.

With best wishes....

Sincerely,

William S. Halstead
William S. Halstead

CC to William Lupoletti ✓
Dr. Stephen Cary
Richard Crompton
Richard Burden

WABQ

Haverford College Radio Club

Uses 2700-Volt Exide Battery Plate Supply System

WABQ, the radio broadcasting station of the Haverford College Radio Club, Haverford, Pennsylvania, is one of the most powerful storage-battery-operated installations in the country. Originally equipped with a fifty-watt transmitter in 1923, when the call letters were assigned, the station has gradually developed until it now has a power of 500 watts, with provision for in-

crease to 1000 watts when required. The station was designed, built, and is operated entirely by students majoring in physics, engineering and mathematics at Haver-

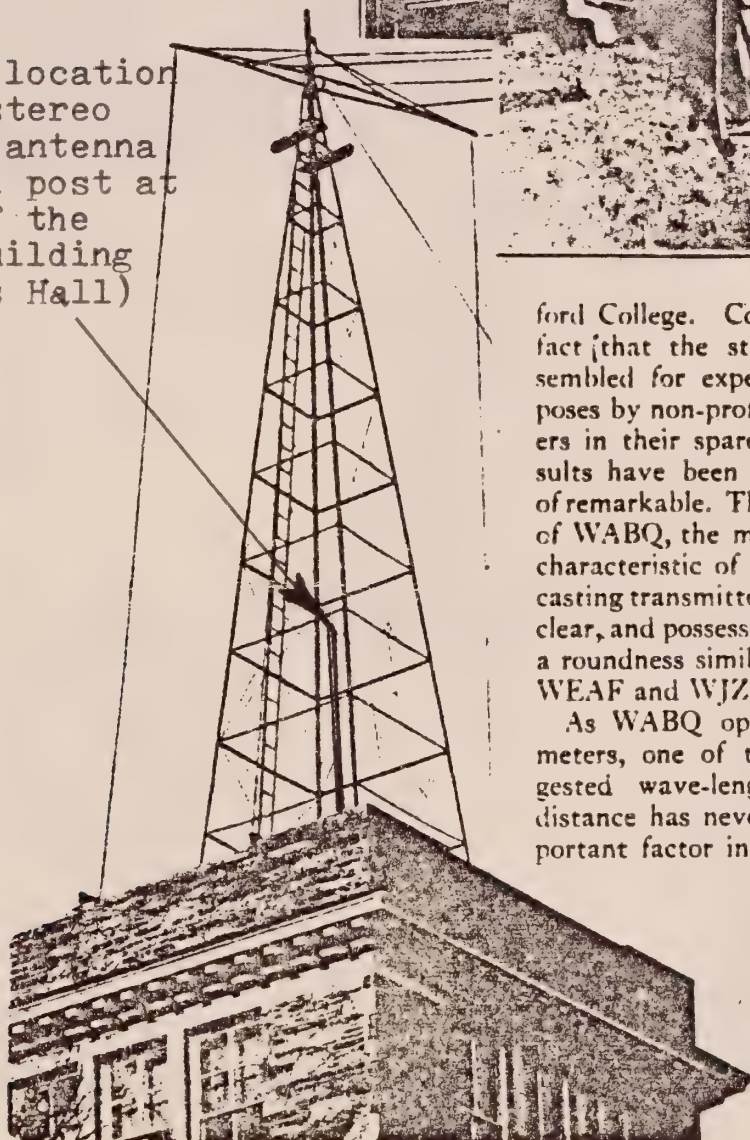
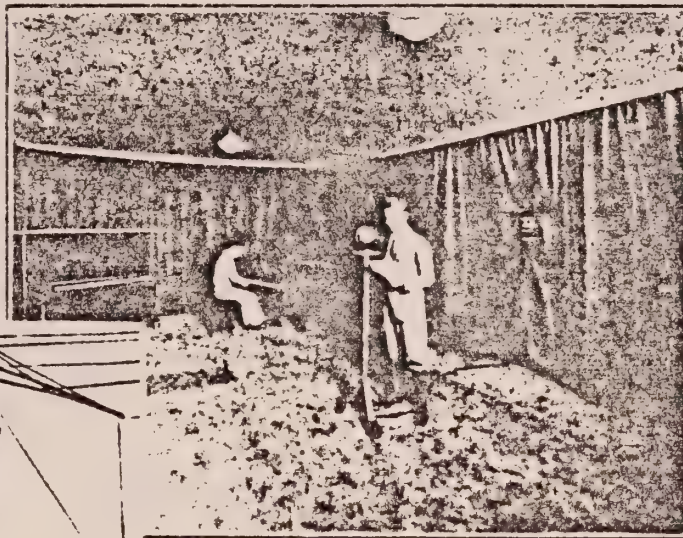
ford College. Considering the fact that the station was assembled for experimental purposes by non-professional workers in their spare time, the results have been nothing short of remarkable. The tone quality of WABQ, the most important characteristic of a good broadcasting transmitter, is unusually clear, and possesses a depth and a roundness similar to those of WEAJ and WJZ.

from Maine to California, and from Canada to Florida. The transmitter is located in the physics building at Haverford, which is ideally situated for radio work. From either of the two steel towers, erected on the roof, an unobstructed view of many miles of rolling country may be had, and the supports of the new Delaware river bridge in Philadelphia, nine miles away, are plainly visible on a clear day. The aerial, which is of the "flat-top" variety, is suspended between the towers, 120 feet above the ground, and connection with the sending outfit in the basement of the building is made by means of a "cage lead-in."

The installation was designed and constructed by William S. Halstead, '27, President of the Radio Club, Irving B. Smith, '27, Vice-President, and Gerald C. Gross, '26, now with the Bureau of Standards at Washington, D. C.

The main control panel is composed of three units, a three-thousand volt rectifier of the vacuum-tube type for charging the bank of Exide Radio Batteries, the master oscillator, which in itself is a complete 100-watt transmitter, and a 500-1000 watt oscillator for energizing the antenna system. The 2700-volt bank of Exide Batteries is the largest installation of its type in the East, and it is neatly arranged in a wooden rack 16' x 7' on the right of the transmitting apparatus.

This battery plate-supply system has replaced a three-phase vacuum-tube rectifier formerly used, and has given very satisfactory service even under extremely heavy loads. The filaments of the large vacuum



Suggested location of an FM stereo broadcast antenna on a metal post at the top of the Physics Building (Sharpless Hall)

ford College. Considering the fact that the station was assembled for experimental purposes by non-professional workers in their spare time, the results have been nothing short of remarkable. The tone quality of WABQ, the most important characteristic of a good broadcasting transmitter, is unusually clear, and possesses a depth and a roundness similar to those of WEAJ and WJZ.

As WABQ operates on 261 meters, one of the most congested wave-length channels, distance has never been an important factor in the operation

of the station, but excellent records have been made. During the winter of 1925, WABQ was heard

tubes are ordinarily lighted from the city mains, but an Exide 250-ampere-hour radio battery may be employed for emergencies in case of failure of the a. c. power supply.

The transmitter control panel is of "dead front" construction—that

the modulation of the station is controlled from a small box mounted on the studio wall, and an intercommunicating telephone set provides contact between the announcer and the operator. Telephone lines are installed between the station and the principal college buildings so that out-of-the-studio lectures, basket-ball games, and other interesting campus activities may be broadcast at will.

Among those who have addressed radio audiences from WABQ are such authorities as Sir George Paish, Dr. Michael Pupin, Captain Donald B. MacMillan, Christopher Morley, and Dr. Harry E. Fosdick. In addition to these are the members of the faculty of Haverford College who give weekly talks from the studio during the college year.

WABQ's musical programs are furnished by the college instrumental and glee clubs, and by the numerous com-

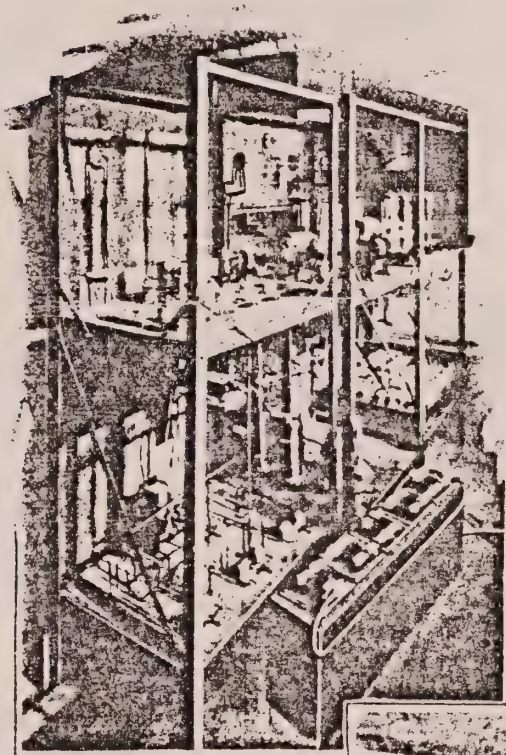
munity musical organizations along the main line; members of the faculties of the leading Philadelphia music schools also have given concerts through Haverford's station.

Charles R. Thompson, '27, a talented young musician, is studio director. In his work he is assisted by Donald Ritchie, '28, the station announcer.

Broadcasts Music from World's Largest Theatre Organ

Perhaps the most popular features of WABQ's offerings are the bi-weekly recitals by Horace Hustler at the console of what is believed to be the largest theatre organ in the world. These recitals are broadcast by remote control from the Ardmore theatre, Ardmore, Pennsylvania, Monday and Friday evenings at 11 o'clock. The construction of the organ, the excellent acoustic properties of the theatre, and the ability of the amplifiers and transmitter to send out perfectly the lowest and highest notes of the musical scale, all have combined to earn for WABQ its present reputation for unexcelled organ transmission—and this term, by the way, has been applied to the college station by communication engineers with the A. T. & T. and Western Electric companies.

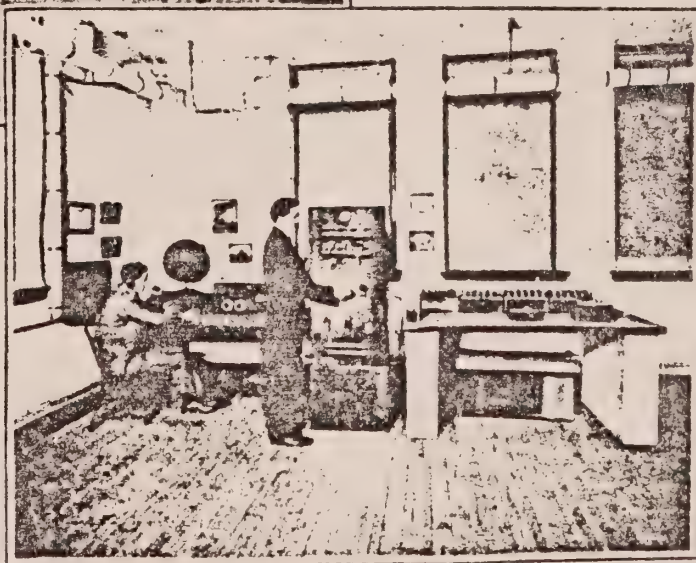
The Haverford College Radio Club also operates amateur short-wave stations, 3-ZG, and 3-BVN.



is, all switches and other parts carrying high voltages are behind the panel, out of harm's way. One man, by means of two small switches, controls the operation of the apparatus.

The receiving equipment consists of three separate parts, a short wave amateur set, and two broadcast receivers, one used to listen for SOS calls, the other to check the station's modulation. Both filament and plate supply for the receivers are obtained from Exide Batteries.

WABQ's studio, reputed to be one of the best in the Philadelphia district, is located near the administration building on the opposite side of the campus. A heavy carpet and attractive draperies are used for the purpose of eliminating echoes and other extraneous noises, which, if picked up by the sensitive Western Electric microphones, would be detrimental to the quality of the transmissions. Two pianos, an upright for popular music, and a grand, are provided. By means of signal lights and relays



The First Steps . . . by WILLIAM S. HALSTEAD, '27

When WABQ was established by the Haverford College Radio Club in the early 1920's, broadcasting was in its infancy. There were no national networks, and few recognized the enormous potential presented by the new communications medium.

So far as I have been able to determine, WABQ was the first student-built and operated broadcast station. With the wholehearted co-operation and, I am sure, a degree of apprehension by Dr. Rittenhouse of the Engineering Department, Dr. Frederick Palmer, Professor of Physics, and with much hard work by members of the club, such as Ed Patterson, '24, Jerry Gross, '26 and Irving Smith, '27, we were able to build all the necessary equipment during weekends and over the Christmas holidays. The transmitter was installed where it was constructed, in the basement of Sharpless Hall.

Those in the club will never forget the excitement of opening night in 1924, when WABQ first went "on the air." Telephone calls, telegrams, cards and letters came in from points along the East Coast, including many messages from alumni who had listened to the new station. Later, thanks to a gift from the Class of 1926, a new antenna was erected on the roof of Sharpless Hall, which supported two steel towers. A contribution from the Ardmore Theatre provided the money to construct transmitting equipment of higher power, equivalent to that of most of the Philadelphia stations at the time. A special dispensation from the Bell System allowed us to connect our "home-made" amplifiers to the lines of A. T. & T. between the radio station and Ardmore.

Highlights of the programs during this period were the broadcasts from the theater of the Main Line Symphony concerts, and the midnight organ recitals of Horace Hustler. There also were many campus broadcasts under the direction of Charles Thompson, '27, from the heavily carpeted and

draped studio that the Radio Club had installed in the basement of the Union.

Many of us will never forget the night when Vachel Lindsay, the poet, in a massive crescendo of his voice during the recital of one of his poems in Roberts Hall, blew a fuse in the transmitter and took the station off the air. Nor, will we ever forget the first microphone of WABQ, fashioned from an ordinary Bell System hand-set, fastened at the small end of one of the cheerleader's megaphones. Later, we raised the money to buy a precious Western Electric broadcast mike. Some chimes, on the wall, were used to identify the station between programs, and perhaps were the forerunner of NBC's musical signature.

In the early period of WABQ's operation, there were no electrical phonographs, and disc records left a great deal to be desired. Practically all broadcasts were "live," from the studio and other points on the campus, or the Ardmore Theatre. The "disc jockey" was unknown. When RCA-Victor introduced electrical recordings, Irving Smith rebuilt an electrical pickup unit from a Stromberg-Carlson phonograph and connected it, through an amplifier, to the studio line. With this, WABQ became one of the first stations to broadcast music from recordings in what, at the time, we considered to be an approach to high fidelity.

In 1927, when commercial broadcasting had come of age, and when most of the club members who had constructed and operated the station were about to graduate, wave lengths were much in demand. What seemed to us, and to long-suffering Faculty advisors, to be an attractive offer was received from the Keystone Broadcasting Company of Philadelphia. After consideration by a student-Faculty committee, the station was sold and moved intact to the city where, by a process of amalgamation, it was combined with a network station.

William S. Halstead, '27, is a telecommunications engineer who has served as consultant to organizations in this country and overseas during the past 25 years. He is a graduate of Haverford, a member of Phi Beta Kappa, and a Senior Member of the Institute of Radio Engineers. In 1953 he was supervisory engineer and consultant to the Nippon Television Network Corporation, Tokyo, in establishing the first commercial television service in the Far East. He also is the author of a proposed North Atlantic Relay Communications plan, termed NARCOM, which is now under consideration in North America and in Europe. In 1959, he was invited, together with three others from the United States, to Moscow to present two papers at the International Electronics Conference of the Popov Society. This provided the occasion for Mr. Halstead to observe television and related electronic developments in the Soviet Union. Many of his findings are included in an article titled, "Television in the U.S.S.R.," which appeared in the



June issue of *Atlantic Monthly* magazine. Mr. Halstead is currently president of Unitel International, Inc., a network planning organization engaged in the development of the proposed NARCOM system. While at Haverford he and other members of the Radio Club constructed and operated the College broadcast station, WABQ.

Correction: The NARCOM plan was under consideration during the 1950s, prior to the advent of communication satellites.

WHRC • NEWSLETTER •

HAVERFORD-BRYN MAWR BROADCASTING INC.

HAVERFORD-BRYN MAWR COLLEGES

HAVERFORD, PA, 19041

(215) 649-1200

March 1983

Hello everyone, this is the new newsletter. It will be printed monthly and give you all sorts of interesting tidbits from all of our departments. Please read all of this very carefully.

PROGRAMMING (Yaz Sanderson)

- (1) always disengage the turntables when you end your show
- (2) fill in the song logs completely
- (3) push the records back in the shelf after or during your show
- (4) always show up on time!

PRODUCTION & PERSONNEL (Diane Davison)

Because of recent absences, a new rule has been instituted, taking effect immediately: YOU MUST NOTIFY either Yaz or me, or leave a note in the log, or find a replacement yourself, should you be unable to make a show. Failure to do this constitutes an unexcused absence(just like high school folks). Two of these and you will NO LONGER HAVE A SHOW. THIS WILL BE STRICTLY ENFORCED, WEEKLY. Sorry that it has come to this. Other neat stuff:

- (1) a list of all our phone numbers(dj's and managers) was sent out to everyone. If you find a replacement, have them leave a log note.
- (2) there are still open time-slots. Know anyone willing to dj or train? Contact me.
- (3) we in production are taking time to make up PSA, Playlist & Community Notes carts. USE THEM. Get used to structured rules and procedures as we go FM. Also announce notices from the RED book. Even boring ones must be read.
- (4) we are currently compiling an alphabetized and numbered catalog of all 600(so far) 45's we have. Look for it, as well as the 45's in the coming weeks. It'll be in the music library in the big milkcrates.
- (5) there now is an "oldies" LP section on the bottom center section. A list of the records in this section will be posted on the wall.
- (6) we are now broadcasting to Barclay and Erdman dorms. We are attempting a hookup to Erdman dining ctr. Announce.
- (7) attached is a list of everyone's shows. Use it.

Let's make this semester a good one for WHRC. I look forward to working with all of you.

OPERATIONS (Lionel Cassin)

Many dj's have been experiencing difficulties in Studio A. This is due to the fact that the studio has been totally rewired to rectify the obsolete and decaying wiring from years ago. Only Sheridan and

the microphone are still having problems which we're working on. Thanx for your cooperation.

BUSINESS (Larry Taylor)

We are currently waiting for the FCC to settle its rulemaking changes. Hopefully, that will happen this summer. In the interim, we are trying to work out a way to get some airtime on another local educational FM station. We'll keep you informed. Any specific questions, give me a call.

MUSIC (Jenny Mitchell)

On TUESDAY, MARCH 8, there will be a meeting in the station at 8:30PM to discuss: record reviewing and ordering, the record library, and music education. Everyone is welcome, we'd appreciate your input.

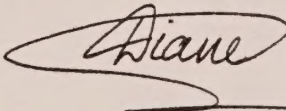
Well, this wraps up our Newsletter. Any questions, call any of us. And especially remember all the important things mentioned in this rag.

WHRC quote of the month:

" Silence is the wit of fools." -La Bruyère

..so blast that music, wrap to the beat, and let the bi-college community know who to listen to!

Happy Airwaves,


Diane

and information are still being processed, we're working on
them for your information.

Respectfully,
[Signature]

As we continue working on the 2012-2013 release
schedule, I hope you will be able to help us in the future.
We are looking for a way to get more information on another level
of information. We'll keep you informed. Any specific ques-
tions, please let us know.

Thank you,
[Signature]

On Tuesday, March 27, 2012, there will be a meeting in the station at
10:00 AM. Please arrive on time and bring all the necessary information.
and make an action. Everything is welcome, we'll appreciate your input.

Well, this is a very important meeting. Any questions, call
any of us. We'll be there to help you. All the information will be discussed
in this meeting.

My name is [Name].
I am the [Title] of [Company].
I am looking for a way to get more information on another level
of information. We'll keep you informed. Any specific ques-
tions, please let us know.

Respectfully,
[Signature]

[Signature]

Student Board of Managers of WHRC

Cassin, Lionel
Technical Manager, H.C. class of '85

Dearhouse, Elisa
News and Public Affairs Manager, B.M.C. class of '85

Luftglass, Rick
Music Manager, H.C. class of '84

Meirowitz, Suzanne
Programming Manager, B.M.C. class of '84

Shechter, Jamine
Personnel and acting Operations Manager, H.C. class of '84

Taylor, Larry
Business Manager, H.C. class of '84

